

World Health Day 2014



**SMALL BITE:
BIG THREAT**

Vector-borne diseases in India

An analysis from a health systems approach



Malaria • Dengue • Lymphatic filariasis • Kala-azar • Japanese encephalitis • Chikungunya

World Health Day 2014



Vector-borne diseases in India

An analysis from a health systems approach

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Acronyms and abbreviations

ACT	Artemisinin-based Combination Therapy
AES	Acute Encephalitic Syndrome
ANM	Auxiliary Nurse Midwife
ASHA	Accredited Social Health Activists
AYUSH	Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy
BCC	Behaviour Change Communication
Bsc	Bachelor of Science
CASA	Church's Auxiliary for Social Action
DEC	Diethylcarbamazine citrate
GHC	Government Health Centre
IEC	Information, Education and Communication
IMA	Indian Medical Association
IRS	Indoor Residual Spray
IVM	Integrated Vector Management
JE	Japanese Encephalitis
JMM	Joint Monitoring Mission by WHO and the Government of India, 2014
LLINs	Long lasting insecticide treated nets
MPW	Multi-purpose Health Workers
NGO	Nongovernmental Organization
NHM	National Health Mission
NIV	National Institute of Virology
NRHM	National Rural Health Mission
NUHM	National Urban Health Mission
NVBDCP	National Vector Borne Disease Control Programme
PCD	Passive Case Detection
PIP	Project Implementation Plan
RDK	Rapid Diagnostic Kit
RDT	Rapid Diagnostic Test
UPHC	Urban Primary Health Centre
UT	Union Territory
VBD	Vector-Borne Diseases
VHSNC	Village Health Sanitation and Nutrition Committee
WHD	World Health Day
WHO	World Health Organization

Executive summary

Every year, on 7 April, the world, including India, celebrates World Health Day (WHD). This is an opportunity to motivate governments and communities to take action to improve the health of populations. The theme selected for WHD in 2014 is vector-borne diseases (VBDs) and the slogan for this occasion is Small Bite: Big Threat. The purpose is to create awareness on the threat of VBDs and renew efforts for their sustainable control, elimination and eradication.

VBDs represent a substantial burden in many low and lower middle income countries, including India. Mosquitoes, ticks and other insect vectors are increasingly developing resistance to insecticides. They result in loss of productivity, school absenteeism, deeper impoverishment, higher health care costs, and a subsequent burden on public health services.

Globally, VBDs are endemic in more than 100 countries. These diseases affect more than half of the world's population; they are difficult to predict, prevent or control and to add to the complexity, for most VBDs there is no available vaccine.

In India, the Directorate of National Vector Borne Disease Control Programme (NVBDCP) is the central agency for the prevention and control of the six most common VBDs in the country, namely: malaria, dengue, lymphatic filariasis, kala-azar, japanese encephalitis and chikungunya.

In this document we have applied a health systems approach to analyse the problem of VBDs and to explore areas of policy action. Although the impact of VBDs in India, which mostly affect poor populations, is linked to specific social determinants of health, we argue that the existence of an effective health system must be at the core of the efforts to successfully control these diseases.

This approach enables us to propose recommendations that are conducive to a sustainable control of VBDs for **all** in India. In this regard, the recommendations of this document clearly define the need to strengthen four core health systems functions for a sustained control of VBDs in the country, specifically: financing, resource generation, service provision, and stewardship.

These recommendations are in line with those from the Joint Monitoring Mission (JMM) on VBDs, recently undertaken by the World Health Organization and the Government of India (1-10 March 2014). The JMM reviewed the country's progress towards VBD targets of the National Health Policy (2002), malaria related Millennium Development Goals, and challenges and plans for vector control efforts.

These functions can also be accompanied by intersectoral efforts to reach other sectors and influence them to improve the social determinants of health linked to the epidemiology of VBDs (e.g. access to clean water and sanitation, adequate housing, planned urbanization, etc.).

Background

Every year, on 7 April, the world celebrates the World Health Day. On this date, which commemorates the creation of the World Health Organization (WHO), a specific public health topic is chosen in order to draw attention to a subject of major importance in global health. The aim is to raise awareness and motivate governments and communities to take action to improve the health of populations. The topic selected for WHD in 2014 is vector-borne diseases and the slogan for this occasion is Small Bite: Big Threat.



Aedes aegypti

WHO

The problem

Globally, billions of people are at risk from viruses and bacteria transmitted by mosquitoes, ticks, fleas and other vectors. The most widely known VBD globally is malaria. However, dengue, which is caused by an arbovirus virus and is a major public health challenge in India, infects as many as 400 million worldwide each year¹, some fatally. As global and land use increase, the risk of acquiring vector-borne pathogens also increases. Evidence shows that VBDs have intensified their severity due to climate and environmental change and globalization².

VBDs are endemic in more than 100 countries; and are known to affect more than half of the world population³. Death among children due to VBDs is very high in low-income countries. Besides, it is estimated that all low-income countries are affected by at least five VBDs⁴, which are major killers of children under the age of five years⁵. For example, according to the latest WHO estimates, there were about 219 million cases of malaria in 2010 and an estimated 700 000 deaths. About 90% of all malaria deaths occur in children under five years of age. The same estimates reported one million malaria cases in 2010 in India⁶.

VBDs hit mainly poor populations; almost 70% of countries and territories affected by VBDs are low income and lower middle-income countries. These diseases are the most common affecting poor people in the world living on less than US 1.25\$ per day⁴. Recently, malaria and dengue have seen an upsurge in India⁷. Most VBDs are among what Hunt calls “type III diseases”: those with extremely little research and development, and no commercial research and development in high income countries⁸. VBDs result in loss of productivity, school absenteeism, deeper impoverishment, higher health care, and a subsequent burden on public health services.

The mortality due to VBDs and their negative impact on poor populations can be explained by their association with social determinants of health such as clean water, sanitation, urbanization, poverty, mass migration, or conflicts. This explains why most VBDs remain inextricably linked with poverty. It is not a coincidence that most of the mortality rates due to VBDs are seen in countries with the highest rates of extreme poverty⁶.

Very often communities are at risk for more than one VBD. These diseases are very difficult to predict, prevent or control. For most of them there is no available vaccine. Moreover, mosquitoes and ticks are difficult to eliminate. Their resistance to insecticides, one of the main elements used in their control is increasing, probably because of gene mutations in the vectors. Adding to the complexity, almost all vector-borne pathogens are zoonoses, meaning they can propagate and live in animals as well as humans⁹.

The tragic paradox of the epidemiology of VBDs is that effective prevention and therapeutic interventions, based on robust evidence, exist for most of them. Moreover, as we will see in the following sections, guidelines for the case management of these diseases have been adopted in India. If these interventions would be administered in a timely manner, a considerable proportion of the morbidity and mortality caused by VBDs could be averted¹⁰.

Box 1. Action at the global level

Considering the burden of VBDs, their impact on the poor, the mandates and actions adopted by the international community to achieve the Millennium Development Goals, in 2013 the Sixty-sixth World Health Assembly stated that:

1. There is a need to strengthen disease surveillance systems especially for VBDs.
2. The quality of essential medicines for the prevention of VBDs must be ensured, guaranteeing continuous availability and affordability of drugs.
3. There is a need to increase financial resources to flow in a sustainable manner.
4. There is an urgent need to improve the management of the supply chain through forecasting, timely procurement of quality assured goods, and good stock management.
5. The integration these diseases in primary health care services and immunization campaigns is needed to achieve greater coverage's and also bring down operational costs.

Some notes on current strategies on vector-borne diseases and potential new directions

A majority of researchers indicate that the adoption of national strategies is a central action for the effective diagnosis, prevention and control of VBDs. Strategies on VBDs has the potential to not only reduce the burden of these diseases but also to contribute to poverty alleviation⁹. Consequently, lack of strategies in this area often results in an inefficient use of public resources, ineffective public health operations, adverse effects on health and the environment, increased exposure and vulnerability to disease vectors, and other social impacts. Prevention and control, when implemented in an integrated manner with a health system approach, is highly effective.

Although this is a set of diseases with different pathologies, in general national strategies to address VBDs include the following common actions:

1. Disease and entomological surveillance;
2. Case management with laboratory diagnosis and drug treatment;
3. Integrated management of vector sources, vector reduction, chemical control of vectors and legislation, and
4. Supervision and monitoring with regular reporting and data analysis.

A potential direction for policy implementation in this area is the adoption of a health system approach for the control and elimination of VBDs. The task of a national strategy on VBDs is to ensure the timely delivery of preventive and therapeutic interventions for **all** who need them. Following the concepts included in the right side of Figure 1, we argue that in order to succeed in implementing such a strategy, we should adopt a health systems approach. This will ensure that an effective health system will be in place; a system that:

1. Can deliver VBDs interventions that reach all, ensuring universal coverage to the whole of these interventions¹¹;
2. Is responsive to the expectations of the populations it serves;
3. Is managed and performs efficiently, realizing the full potential of its resources; and that
4. Protects the population from impoverishment as a result of VBDs.

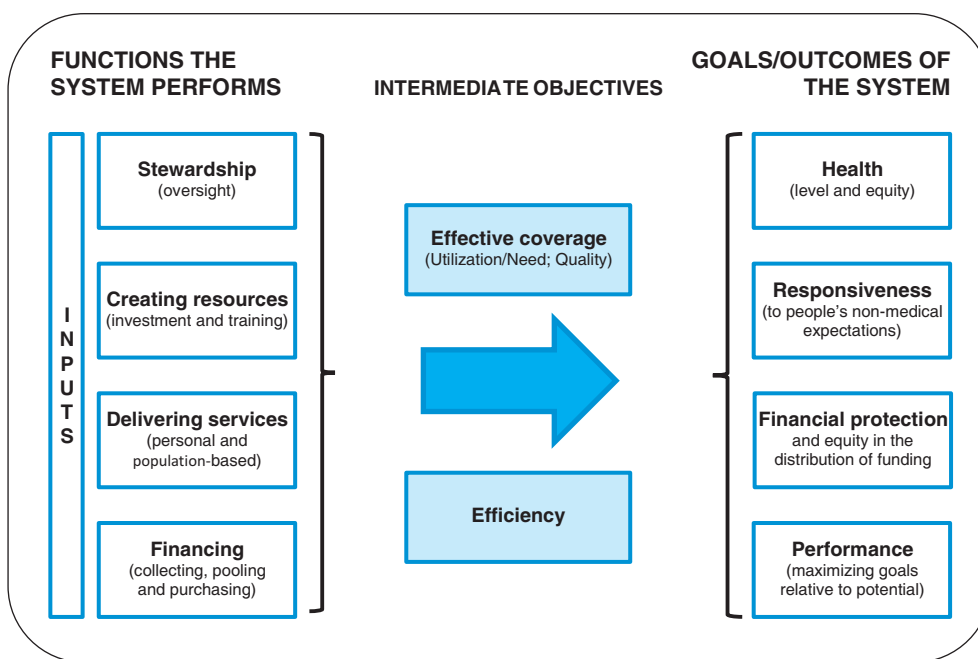


Figure 1. Health Systems Assessment Framework: functions and goals¹²

Taking a health systems approach, and following the concepts included in the left column in Figure 1, a strategy for VBDs should, therefore, ensure four core functions that will secure access to interventions for all that need them¹², namely:

1. Adequate and equitable **financing** to ensure sustainable revenue collection for the purchase of health services for VBDs;
2. Generation of adequate **resources** including human resources, procurement and supply of drugs for VBDs, medical technologies, and available health facilities of quality and efficacy;
3. Delivery of personal and population-based health **services** of quality for all, and
4. A strong **stewardship** function to formulate evidence informed policy and inter-sectoral work based on a surveillance system that provides intelligence for strategic actions to control VBDs.

In the subsequent sections, we will review these concepts to further highlight their relevance in the analysis of policy and program issues to expand VBDs interventions for all.

In the context of India, these recommendations call on policymakers, in general, to embark on a process for the gradual de-verticalization of its public health programs. The core message is the need to adopt a health systems approach that, centred on the needs of the individual, provides services at the first point of contact that includes VBD interventions together with interventions to address other illnesses.

Determinants of vector-borne diseases

As mentioned in previous sections, evidence shows that the epidemiology of VBDs and the distribution of their negative impacts across population groups are closely linked to specific social determinants of health³¹. Overall, the conditions in which people are born, live, and work are directly reflected in the epidemiology of most VBDs. We provide here some information about these determinants and how they operate.

1. Water

Water is often a source of infection and a breeding ground for vectors. Inadequate sanitation and exposure to human faeces are linked to the transmission of VBDs¹³. The inclusion of personal hygiene and cleanliness demonstrates the importance of access to adequate water supply for drinking and washing⁸. Vectors often breed in domestic water sources. This is the case for mosquito vectors of malaria, dengue, and lymphatic filariasis. Inadequate public water supply through water wells¹⁴ or piped systems¹⁵ has been found to be a factor in inappropriate water storage, providing breeding sites for the dengue fever vector. Access to water and sanitation is influenced by more structural determinants like poverty¹⁴.

2. Housing

The physical characteristics of the house (including materials and design); the peri-domestic areas where a house is built (including kitchen gardens, vegetation, solid waste dumps and domestic animals); and crowding has documented linkages with the spread of VBDs^{8 16}. It is reported that the expansion of informal urban settlements close to vector habitats combined with inadequate housing practices increase exposure and close contact to vectors¹⁷. In Bihar, housing material, in-house granaries and the presence of bamboo trees near houses in new settlements were risk factors of kala-azar¹⁸. Other factors like unplanned urbanization and lack of basic health services and increasing migration are closely linked to the resurgence of dengue disease¹⁹.

3. Climate

Climate change has considerable consequences in the global distribution of VBDs¹⁴. Outbreaks of VBDs in Bangladesh are related to climatic factors as well as a number of environmental factors^{20 21}. Climate change also affect transmission of dengue as mosquitoes reproduce more quickly and bite more frequently at higher temperatures^{22 23}.

It has also been found that higher temperatures increase three aspects of transmission for vector-borne pathogens: vector biting rate, vector development rate, and pathogen replication, thereby reducing the extrinsic incubation period or the time between a vector feeding on an infected host and being able to transmit the pathogen²⁴. Construction of large dams for hydroelectricity and other developmental projects have been linked with an increase of breeding sites of vectors⁸.

4. Poverty

Poverty is related to access to clean water, sanitation, adequate housing and unplanned urbanization²⁵; it can also be a consequence of VBDs due to medical treatment costs or indirectly through loss of earnings. Impoverishment due to diseases leads to increased vulnerability. High rates of dengue and leishmaniasis are common in underprivileged areas in India²⁶.

A study from Bangladesh confirmed the financial impact of kala-azar and described common coping strategies that impoverish families²⁷. Treatment can be free, yet costs like transport or incomes lost, influence savings depletion, sale of assets, or borrowing at high interest rates^{8 28}. In Orissa, studies concluded that chronic lymphatic filariasis patients lost 19% of working time per year²⁹.

5. Air travel

The growth in air travel enabling global transit in a single day seems to have accelerated introductions of VBDs in countries where they were not common. It has allowed many pathogens that are acutely infectious (e.g., chikungunya viruses) to reach other continents within a few days, during which time, hosts remain infectious, and even during the latent period for some diseases.

6. Health systems

Finally, the health system itself, and especially how it is organized, is a key determinant of VBDs. If the system does not protect from impoverishment, creates access barriers to it, or has a low responsiveness that creates barriers to demand for services, it will eventually increase the exposure to vectors and the diseases they carry, and delay much-needed medical interventions.

India's health system is often inaccessible for the poor; financial burden for healthcare falls overwhelmingly on households with high out-of-pocket expenditures, which account for more than 75 percent of health spending. This is demonstrated by marked variations in hospitalization rates by gender, wealth, and urban-rural residence. In this regard, a health systems approach is critical to ensure adequate control of VBDs³⁰ ensuring financial protection from diseases that can result in catastrophic expenses.

The situation in India

In India, the challenge VBDs pose is serious because the increase in geographic distribution of vectors and VBDs have the potential to affect 90% of the population. However, efforts to scale-up interventions to universally reach the population usually encounter the following problems:

1. A weak and fragmented health system unable to reach all populations at risk.
2. Poor collaboration across agencies, sectors, and levels of government that calls for an improved inter-sectoral work that can facilitate the adoption of integrated approaches.
3. Lack of effective regulatory mechanisms to address issues like drug and insecticide resistance by vectors³¹.
4. A weak, inadequate, and in some cases inexistent, surveillance system to monitor cases, risk factors and determinants of VBDs, to provide intelligence for strategic decisions.

The National Vector Borne Disease Control Programme (NVBDCP) is charged with the prevention and control of VBDs. The union cabinet in India, vide its decision dated 1 May 2013, approved the launch of National Urban Health Mission (NUHM) as a sub-mission of an over-arching National Health Mission (NHM), with National Rural Health Mission (NRHM) being the other sub-mission of NHM.

Within the broad national parameters and priorities, states have the flexibility to plan and implement state specific action plans. The state project implementation plan (PIP) spells out the key strategies, activities undertaken, budgetary requirements and key health outputs and outcomes, which includes the case of VBDs.

Box: Epidemiology related to vector-borne diseases' burden in India	
Malaria	<ul style="list-style-type: none"> • 1.06 million cases in 2012 • 90% of malaria cases were reported by 12 states, namely Odisha, Jharkhand, Chhattisgarh, Maharashtra, Madhya Pradesh, Gujarat, West Bengal, Uttar Pradesh, Assam, Rajasthan, Andhra Pradesh, and Haryana
Kala-azar	<ul style="list-style-type: none"> • 13 869 cases in 2013 and 20 deaths • Endemic in Bihar, West Bengal, Assam, Tamil Nadu during pre DDT era • Re-appeared during seventies and at present > 80% of all cases reported from Bihar. Nine districts in Bihar contribute 65-70% of cases • 28 292 cases and 110 deaths in 2010 (74 000 cases and 167 deaths in 2013) • Endemic in 31 states
Chikungunya	<ul style="list-style-type: none"> • Re-emerged in 2006, 1.39 million cases in 13 states. Endemic in 19 states
Japanese encephalitis	<ul style="list-style-type: none"> • 5149 AES cases and 677 deaths in 2010 • 10709 JE positive cases with 199 deaths were reported in 2013, with more than 85% contributed by five states - Assam, Bihar, Tamil Nadu, Uttar Pradesh and West Bengal.
Filariasis	<ul style="list-style-type: none"> • Endemic in 250 districts of 15 states and five UTs • 600 million population at risk • 40 million infected, one-third of global cases
Sources: 12 th Five Year plan working group on communicable diseases 2011; World Malaria report, 2011; NVBDCP updated programme data as presented in the JMM (2014).	

The findings of the joint monitoring report prepared by WHO and Government of India in 2007³² showed that the situation of VBDs in the country correlates with the global patterns in terms of populations affected and determinants of VBDs. The report found that VBDs that are serious public health threats in India include:

1. Malaria,
2. Dengue,
3. Kala-azar,
4. Lymphatic filariasis,
5. Chikungunya, and
6. Japanese encephalitis

Around 95% of the Indian population lives in areas at risk of malaria. Annually, more than 100 million blood slides are examined for malaria, with around one million cases of malaria reported in the country. Populations affected are mostly low-income groups, earning less than Rs 6000 per month. Of these, around 50% are falciparum malaria cases. Annual malaria incidence in India is 0.69 cases/1000 population³³.

Dengue is mostly an urban public health problem; however, outbreaks are being increasingly documented in rural areas also. An epidemic was reported in 2012, with over 50 000 cases and about 250 deaths. Moreover, a major epidemic of chikungunya was reported in 2008 with about 1.3 million cases in 213 districts in 15 states. Though it is showing a decreasing trend, cases continue to occur, particularly in southern states of India.

Kala-azar is prevalent in four states with almost 14 000 cases in 2013 with 20 deaths in the same year. It is endemic in 48 districts of Bihar, Jharkhand, Uttar Pradesh and West Bengal. Sporadic cases have also been reported from other districts. Cutaneous leishmaniasis has been reported recently from certain pockets in the Western Ghats of Kerala.

Lymphatic filariasis is prevalent in 20 states and union territories with 250 endemic districts and 600 million people at the risk of infection. About 40 million are infected every year. This number accounts for one-third of global cases. The microfilaria rate is more than one percent in 100 districts in the most isolated and deprived areas of the country.

Japanese encephalitis (JE) across the country accounts for less than 15% of all Acute Encephalitis Syndrome (AES) as the incidence has declined with introduction of an effective vaccine. The patterns of AES are different in different states caused by a range of etiologic agents, which has prompted the Government to employ a multi-sectoral collaborative approach to control AES. Japanese encephalitis is reported to occur in southern, north and north-eastern states, with about 1000 cases annually and deaths ranging from 100-200 in number³⁴.

Applying a health systems approach to improve action on vector-borne diseases

In India, the strategy adopted by the National Vector Borne Diseases Control Programme includes the following actions:

1. Support state efforts to undertake sector wide health system strengthening.
2. Incentivize states and UTs to undertake health sector reforms.
3. Build capacity for decentralized outcome based planning and implementation.
4. Integrated facility development planning.
5. Strengthen the sub-centre/Urban Primary Health centre (UPHC) and prioritize achievement of universal coverage.
6. Empower Accredited Social Health Activist (ASHA) and strengthen Village Health Sanitation and Nutrition Committee (VHSNC).
7. Partnerships with nongovernmental organizations (NGOs) and with private sector.
8. Enhance use of information and communication technology.
9. Strengthen health management information systems and establish accountability frameworks at all levels.

These elements define the human resources skills that need to be strengthened in order to control these diseases, like operational research, behaviour change communication (BCC), social mobilisation promotion, information, education and communication (IEC) activities, and inter-sectoral action among agencies and at different government levels³⁵. For most VBDs, effective interventions exist. Current health strategies and policies in India highlight that equity should be achieved in the delivery of health care services.

We argue that a VBDs strategy in India should concentrate in the building of a robust health system able to support the local capacity. This would ensure that right diagnostics and treatment would be available for anyone who needs it³⁶. A health systems approach to VBDs is founded on the four critical functions depicted in Figure 1: financing, resource generation, service delivery, and stewardship. We present below some areas of action, listed under each function:

1. Financing³⁷

Funds for India's national strategy on VBDs come from the central and state governments, as well as external aid provided by donor and bilateral agencies. In the 12th Five Year Plan, the total outlay increase was 54%, yet the

increase for malaria was only 12%.* However, budget for VBDs in the 12th Five Year Plan decreased to 1.63% of the overall health sector budget against 3.51% in the 11th Five Year Plan period. This reduction occurred despite the fact that the ministry budget has increased.

From the total outlay received for VBDs consisting of INR 31 909.70 million (or USD 514.67 million), only INR 19 497.90 million (USD 314.48 million) was actually spent. As a result, the actual expenditure on VBDs was 60% of original plan outlay. This is an indicator of the ability of the Ministry of Health & Family Welfare to effectively utilize funds to deliver the full range of services. Low expenditure in previous years is often a major factor for lower allocations in subsequent years. If, in addition, almost 70% of the Indian population does not use government health services and VBDs interventions, and public authorities only spend 60% of the original plan outlay they envision, it may be time to reformulate the strategies for universal coverage of VBDs in the country.

Around 25% of the total budget is transferred to state health actors, as health is a state subject in India. The low budget execution has largely been a result of delays in the tendering processes within the VBDs program. Procurement activities were, on an average, around 60% of the total budget since 2007 to 2013.

External funding provided by the World Bank and Global Fund is another source of lessons. The budget estimate from 2007 to 2012 was INR 9327.00 million (US \$ 150.43 million) out of which only 73% was spent. State governments fund the human resource and administration of the state malaria offices through their non-plan budget. Many state governments also have their own schemes for VBDs, which result in duplication and lack of coordinated effort.

There are three agencies that have reviewed financial monitoring. The World Bank and Global Fund teams are led by external consultants. The Domestic Budget Support team is led by the Ministry of Health. There are variations in the capacities of these teams and the processes they follow. For example, financial monitoring by the World Bank and the Global Fund is detailed and process-driven as compared to that of the domestic team. Financial monitoring within the ministry team is weak due to absence of key financial information and probably limited for effective monitoring.

There is additionally no consolidated customized finance manual covering all aspects of internal control and financial management. State specific financial and procurement rules need to be followed by the State VBDs offices. The ministry does not have a system of regularly monitoring the audit findings and observations such as utilization certificates etc. Rules on purchasing of services from health providers were not available.

* Outlay refers to the amount of budget requested by the Ministry of Health & Family Welfare to the Ministry of Finance. Very often the budget amount transferred effectively to the Ministry of Health is lower.

Therefore, there is a need to adopt financing changes for universal access to VBDs interventions in the context of a health systems approach. This implies overcoming financial barriers that prevent access to VBDs interventions and the health system in general. This implies the elimination of out of pocket expenditures and indirect costs.

There is a need to explore the funding and effective services for VBDs that can be provided in a common delivery platform with interventions for several diseases. Vertical approaches create inequities in access, inefficiencies in the allocation of resources and inequities in financing. There is a need to explore whether insurance schemes could be created or existing ones expanded with a universal coverage approach. There is also a need to develop resource allocation mechanisms that can foster productivity and quality, and explore mechanisms to ensure effectiveness in the usage of earmarked resources allocated for fighting VBDs³⁸.

2. Resource generation

2.1 Procurement

Generation of adequate resources including human resources and procurement and supply of drugs and medical technologies, and available health facilities of quality and efficacy, ensure availability of inputs needed for interventions that prevent and control VBDs¹⁴. Overall **procurement** activities undertaken by public providers of health services are in need of targeted improvement.

A recent independent report found that the procurement unit of the NVBDCP is poorly staffed and has inadequate purchase experience or competence. The same report mentioned that there are inadequate skills to identify the intricacies of modern procurement processes and a limited capacity to make the case for a strengthened procurement function at the level of the NVBDCP⁴⁶. Although an external procurement agent has been contracted to arrange procurement for VBDs once demand is projected, the same report found that this agent adopts a routine approach. As a result, there are delays in supply and cases of funds unutilized⁴⁶.

A report of the World Bank pointed out that delay in procurement and distribution of bed-nets (LLINs) has hampered implementation and full achievement of results, and mentioned that progress was moderately unsatisfactory³⁹. It is suggested that it would be critical that the procurement cell of the VBDs unit is strengthened. An analysis of the procurement process also revealed continuous and consistent delays everywhere in procurement, and no coverage in quite a few cases⁴⁰. The main recommendation produced to date in this area calls for establishing a procurement cell with experienced procurement specialists, with adequate seniority to make the case of VBDs control in discussions at Ministry. Indeed, there are plans for the autonomous Central Medical Services Society to take over all procurement for the MOHFW in the near future.

2.2 Human resources

There is a shortage of human resources in health especially of qualified health workers such as ASHA, ANMs and of multi-purpose health workers, who are in most instances the backbone of the NVBDCP at the grassroots level. Human resources are the largest component of health care delivery in India and accord for two-thirds of total health budget of the country⁴¹. Observations from a recent study suggest that for most uncomplicated VBDs cases, the highly specialized skills of physicians as frontline providers may not be necessarily required. Retaining physicians to serve in health facilities often located in rural areas is difficult. The physical conditions in those areas and the expectations and attitudes of medical graduates make retention difficult⁴².

Many Indians living in rural areas, therefore, receive care from unqualified providers. A comprehensive human resources policy is needed to achieve full coverage not only for VBDs but also of comprehensive health care in India⁴³.

The institutional environment for planning and decision making for human resources for health in India is weak, especially in states that lag behind in VBDs control. A review mission on the performance of health sectors undertaken in 2012 recommended that the Regional Offices for Health & Family Welfare of the Ministry of Health of India should have staff for monitoring the needs for human resources. It was suggested that the central and state governments within which, the National Health Mission operates, should address the human resource vacancy and deployment issue⁴⁴.

Policymakers recognize that meeting the challenges of assuring sufficient numbers of well-trained and motivated health workers is critical for improving health outcomes⁴¹. Number of workers, location, knowledge, skills, and motivation are issues that require a new approach to go beyond better salaries. There are some key areas⁴² that we need to address to increase coverage, motivation and capacities of a work force to address comprehensive care, and within it, the relevant VBDs:

1. Numeric adequacy,
2. Skill mix,
3. Social outreach,
4. Satisfactory remuneration,
5. Workplace environment,
6. System support,
7. Training and learning, and
8. Leadership and entrepreneurship.

Efforts to address adequacy and retention in rural areas could focus on non-physicians like community health workers, who are often more

receptive to government and rural postings. Yet, measures to train, provide incentives and recognition are needed to transform them into reliable independent health services providers. This requires developing new training programs, new cadre rules, and professional institutions and in general a broader approach beyond expanding posts or building nursing schools⁴².

The central government has recently approved the introduction of a new public health specialization (Three year BSc in Community Health plus internship) with candidates selected from rural areas and working at sub-center level as first-contact care providers. A core challenge for states will be to overcome the potential resistance from professional associations. The High Level Expert group on Universal Health Coverage and the 12th Five-Year plan, also pointed out that AYUSH workers need to be utilized optimally by providing them appropriate training and skill upgradation.

Inadequacy in support functions including facility management, supplies and logistics management, accounting and public health planning at state and district levels are major constraints to more effective service provision⁴². States need to address the issue of inadequate human resources to improve these support functions. Strategies to improve human resources for health by states also need to couple increasing resources for production, recruitment, and retention with incentives and conditions for bringing about institutional change.

Several states provide cash incentives to multi-purpose health workers (MPW) in high endemic districts in order to strengthen surveillance, treatment, prevention and control of malaria and other VBDs. ASHA's, anganwadi workers and MPWs are trained on the use of rapid diagnostic tests (RDTs) and artemisinin-based combination therapy (ACT) for malaria diagnosis and treatment at community level. These strategies could be further explored to expand human resources availability and capacity.

2.3 Infrastructure

Public infrastructure systems have made a slow progress in India. The creation of the new facilities and infrastructure at sub-centers and district levels needs strengthening. This compromises quality of appropriate treatment and care, particularly for life-threatening illnesses like dengue and JE. Expenditure fund flows for infrastructure development needs be separated from fund flows on revenue expenditure and an effort should be made to foster infrastructure development at local level⁴⁵.

The question on what influences a decision on where to seek care is partially explained by the lack of government health infrastructure. Public facilities many times fail to deliver. Public centers are closed for more than half of the time in some states. As a result many choose private providers who are often unregulated and unqualified. These decisions have little to do with the quality of care per se but rather with the general management and availability of health services⁴⁶.

3. Service delivery

Delivery of personal and population-based health interventions to prevent and control VBDs together with the rest of health care is at the core of any strategy on VBDs. These interventions aim at supplementing case management functions, as well as population based health interventions, and integrated vector control management.

3.1 Case management

For case management for malaria, ACTs were introduced for treatment of *P. falciparum* malaria in 2008 in the high endemic districts and throughout the country. In 2010, RDKs were introduced in the programme in 2007 for field workers and for health facilities that do not have microscopy. The private sector was sensitized to follow the national guidelines for treatment of malaria. Surveillance systems are strengthened by the involvement of ASHAs/Surveillance Workers/Community Volunteers for Passive Case Detection (PCD).

For dengue, chikungunya and JE, there is capacity for surveillance, case management, vector control and inter-sectoral collaboration in every municipality/corporation. In India, a total of 394 sentinel sites and 14 apex reference laboratories are established and diagnostic kits procured from NIV Pune are supplied to all the centres.

For kala-azar, diagnosis and treatment are made available free of charge at all government health centers (GHC). Private sector also refers the cases. Similarly, private providers for kala-azar use their facilities to diagnose cases and help in ensuring treatment compliance by getting involved through various partnership schemes and thus contributing in achieving the elimination of this disease. RDKs, miltefosine, are being used in the programme.

Combination treatment with paramomycin plus miltefosine and ambisome single dose is under plan for introduction from year 2014 in selected districts. Elimination of filariasis is through annual mass drug administration of anti-filarial drugs. Blister packing of DEC was introduced and albendazole is supplied. Lymphedema management under programme is home-based hence demonstration is given to the patients for self-practice.

3.2 Vector control

Integrated vector management is another specific strategy adopted under programme, which includes anti-larval, anti-adult vector control measures with social mobilization and community participation. The benefits apply to all VBDs.

Indoor residual spray (IRS) and the distribution of bed nets are the principal vector control measures used for protecting populations. Additionally anti-

larval measures are applied in the community for environmental vector control. Insecticide policy in different areas is revised based on results of vector susceptibility studies and epidemiological impact of IRS⁴⁷.

Vector control must be sufficiently adapted to changing circumstances at local level, where characteristics of vectors, human behavior and the effectiveness of vector control methods varies. Due to climate change, local changes occur more rapidly with significant effects on VBDs. Greater attention needs to be given to local contexts; studies describing local variations. In particular, routine and regular entomological monitoring needs to be addressed to inform application of appropriate approaches at the local level.

Rural and tribal areas as well as urban slums are mostly considered high-risk areas with limited access to quality health care, communications, and other basic amenities. This should call for population health interventions beyond insecticide spraying, bed nets distribution, and address risk factors by focusing on their social determinants that cause their emergence and impact vulnerable population. A review of most VBDs strategies in India does not demonstrate the existence of comprehensive interventions to address determinants like housing, urbanization, increased access to water and sanitation, management of water resources, migration, and overall poverty⁸.

Ensuring adequate resources for responding to VBDs including physical infrastructure, laboratory support and essential drugs are necessary. A plan for human resources in line with the service requirements and burden of disease which outlines the skills required at each level, the timeline for development, training curricula relevant to population needs, and systems for continuing education must be guided by the need to provide effective services to all targeted populations⁴³.

4. Stewardship

Stewardship provides vision and direction for all actors in the system, collecting data to generate intelligence, and exerting influence through regulation and other means⁴³. Stewardship, therefore, influences all the previous functions and ensures that all actions have a strategic direction maximizing the likelihood of achieving system's goals⁴⁸.

Stewardship has several dimensions including formulating policy to provide a strategic vision and goals and to set up clear rules for good use of resources, ensuring accountability¹². Stewardship also includes a role to exert influence on other sectors by using appropriate inter-sectoral tools in order to improve the determinants of health⁵⁶ and a surveillance functions to collect information and evidence to improve health system performance. Intelligence becomes a crucial outcome of systems¹².

There are several issues related to stewardship that need to be enhanced to ensure a sustained implementation of a VBDs strategy in India. In terms of **policy formulation**, health policymaking and implementation are a state responsibility, yet roles are often shared ambiguously, between the central government and the states. They are responsible for the implementation of the right to health, with support and coordination from the union in terms of broad policies, strategic frameworks, and financial resources and medical education. This distribution of roles alone increases the complexities that will imply the formulation and implementation of a VBDs strategy in India in the context of an effort towards universalization of coverage.

In terms of the VBDs programs, problems in the application of policies exist as health ministries at central and state level and are hindered by insufficient **workforce**, frequent attrition and transfers of key state or district level functionaries, insufficient funding, and lack of managerial skills to execute budgets⁴⁹. There is a need to ensure states' involvement in **collaborative health policy** and to set out specific targets to control VBDs in India⁵⁰.

Regulation on standardized guidelines for treatment of VBDs together with other diseases is required and needs to be adapted to the contexts of different states. This implies the need for **closer collaboration** between central and state level health policymakers, which may call the central government to adopt specific incentives (financial, and non-financial) that can ensure a sustained collaboration between different agencies in a way that all parties involved in these efforts find collaboration as a process that results in all-round benefits¹².

Better **surveillance** and good reporting from all stakeholders in relation to VBDs cases, risk factors, determinants, vulnerable group or areas, as well as other relevant information is needed, which calls for a unified, inter-operable information system that can provide good health intelligence⁶¹. Generated data should be analysed at all levels to inform action and decision-making for programme improvement and better impact.

A good surveillance system will also allow health authorities to propose laws and **regulations** to strengthen the VBDs strategy or introduce fine-tuning changes to improve its equity impacts (e.g. regulatory mechanism for urbanization, building codes, management of water sources, laws to regulate private sector providers).

This also implies the need to improve upon **operational research** and **evaluation** of the VBDs program so as to assess the capacities and performance of the different stakeholders involved in VBDs control⁵¹. This is relevant in order to hold accountable all actors involved, including the private sector, which provides about 80% of outpatient care and about 60% of all in-patient care for VBDs.

Recommendations for adopting a health systems approach for action on vector-borne diseases

Based on the areas of analysis covered in this document and the preliminary findings of the Joint Monitoring Mission on VBDs undertaken in March 2014 by the Government of India and the World Health Organization, some recommendations for improvement include:

1. Stewardship

1. Address increased vulnerability of ethnic, socioeconomic groups and geographic locations. It would be advisable to map groups and areas of increased vulnerability for adequate financial and human resources, paired by increased technical and managerial support.
2. Formulate a special strategy to address the high endemicity of VBDs in conflict areas.
3. Expand the contribution of efforts and oversight by urban and rural local bodies. These bodies can be mandated to provide regular feedback on VBDs outbreaks and could be involved in epidemic response, improving systems accountability.
4. Given that the Indian government has adopted as a goal to eliminate kala-azar by 2015, engage the central government in a more direct involvement in the implementation of the strategy to eliminate kala-azar, following similar principles adopted in the successful polio eradication campaign.
5. Based on the evidence collected in the recent years that links the emergence of VBDs to the expansion of urban and public infrastructure in new land areas, accompany industrial, infrastructure development and construction works by minimum mandatory vector source reduction measures preferably backed by a public health act.
6. Separate the governance/oversight functions from executive/implementation functions in order to ensure adequate accountability mechanisms in the implementation of a VBDs strategy. This will ensure a balance between management and technical leadership functions at all levels.
7. Allow the chief medical and health officer to undertake technical leadership functions, while the general administration would play its oversight function.
8. At the state and national level, accountability must be with the general administration, while the procurement officers should be held accountable to complete the procurement in time.
9. Strengthen health intelligence, ensure accurate reporting and support the Integrated Surveillance Program (IDSP), including inter-state and cross-border sharing and reporting.

10. Explore innovative mechanisms to approach other sectors seeking benefits for all sectors involved. Explore the goals other sectors pursue and how health sector can contribute to these goals in a way that health impacts are maximized.

2. Human resources

1. Base all appointments for senior level positions at district and state levels on a combination of qualifications, experience and merit, as a general rule.
2. Every officer appointed in a leadership position at state or district level should undergo an induction programme on VBDs control with certification that could be made available on an e-learning platform.
3. Introduce systematic training on managerial and supervisory skills for all the mid-level managers and supervisors to improve the performance of VBDs units at district and state levels.
4. Include problem solving exercises and case studies drawn from real life situations so that they are able to use information for local action. E-learning would be a valuable supplement for this purpose.
5. Issue clear guidelines for tasks and priorities for: i) areas of high disease endemicity, ii) earlier areas of endemicity, already in surveillance mode, and iii) areas where elimination is achieved or where disease was never endemic for ASHAs, ANMs and MPWs.
6. Make sub-centers the unit of work allocation and district officers able to use state level guidelines for appropriate work allocation, while annual performance reviews would be adopted for peripheral staff.
7. Move towards a regular position of health worker in sub-centers, with clear definition of skills and functions. This will imply to gradually move away from current ad-hoc and contractual approaches for these cadres.
8. Allow states to be able to fix remunerations across different vertical programmes in order to ensure parity across these programs. Currently, the central level defines the payment for each vertical programme, which creates distortions and different economic incentives for health workers at front line level.
9. Explore especial incentives to staff willing to work in remote hard-to-reach locations/ populations.
10. Ensure the provision of a technical supervisor in each block of high endemic districts.
11. Explore ways to pool entomologists into entomology surveillance units to cover a cluster of districts and link them to national institutes of excellence in entomology that provide technical mentorship, skill reinforcement, upgradation and certification for the staff in these units.

3. Procurement and supply chain management

1. Overhaul the whole system in this area in order to adopt a supply chain management system that is benchmarked on key stages of quality

assurance, timeliness and transparency in procurement. A system that at the same time is responsive to facility level supply chain with the best case TNMSC system.

2. Adopt at the national level, a contracting systems with a number of suppliers for the key commodities in VBDs management, including LLINs, ACT/ALT, kala-azar drugs, DEC, RDKs among others, ensuring at the same time the autonomy of states to either tender on their own, or use the national rate contracts, provided they keep to timeliness and quality assurance parameters. States can make it a part of NMM drugs procurement.
3. Allow the use the Global Fund and UNICEF procurement mechanisms as a transient procurement agency to keep commodities in flow in case of delays in contracting.
4. Ensure promotion of indigenous manufacture of quality goods, both for public procurement and in private markets of LLINs, ALT and bivalent RDKs.

4. Resources and infrastructure

1. Establish quality assurance systems for laboratory diagnosis of VBDs as part of public health laboratory following WHO guidelines (Good Laboratory Practices).
2. Call for NCDC/IDSP to contribute to strengthen QA microscopy as part of essential district laboratory function.
3. Implement biosafety guidelines and waste management procedures as per SOPs at all levels including ASHAs (lancets, RDTs etc.),

5. Finance and financial management

1. Ensure adequate and timely release of funds, preferably in a maximum of two installments from center to state and from state to districts (NHM guideline).
2. Use sub-budget lines for justifying requirements and not for audit or expenditure statements as separate cost categories.
3. Introduce flexibility within the envelope along with assurance of requisite outputs being ensured.
4. Examine the cause, whenever fund flow is sub-optimal and utilization is affected, and fix responsibility.
5. Ensure capacity building in district and state for financial management.

6. Case management and service delivery

1. Change first line treatment from As-SP to appropriate quality assured ACT medicines in a phase manner.
2. Re-design the packaging of ACT into improved blisters in order to increase adherence

3. Shift into polio-type strategy in kala-azar control, with direct central intervention and development of capacity of the states for sustainability. Mobilize more resources.
4. Strengthen diagnostic facilities in all public health laboratories.
5. Set-up/strengthen Intensive Care Units, referral systems and feedback to communities starting at district level with staff trained to manage severe health conditions including VBDs.

7. Integration of services

1. Ensure the continuity of vector control services in rural and urban areas. Small urban areas and small municipalities require a special set of control measures that particular and different from rural areas.
2. Guarantee continuity of preventive actions to the point that if case identification is produced in tertiary and secondary centers, local communities are informed and take preventive action with their local health workers and vector control teams.
3. Ensure continuity of care across primary and secondary centers, with secondary services within the district and mechanisms for follow-up care by primary providers.
4. Facilitate more coordination in terms of information and services across private and public providers. Cases detected and treated by private providers are notified and could be followed by public providers.
5. Ensure integration of services across private and public providers. By means of strategies to put in place, public private partnerships and guidelines to operationalize them at local level
6. Adopt mechanisms to make providers (pediatricians, health workers, ASHAs) and ancillary services (blood, ambulance, laboratory, bio-waste management) of vertical programs available for integrated services that include VBDs.
7. Establish the accreditation of all laboratories to allow their usage by the public system regardless if they are in the private or public sector.
8. Integrate and use National Rural Health Mission infrastructure and workforce at first referral units and district hospitals.
9. Explore linkages with National Urban Health mission to involve the private sector to address urban malaria, dengue/chikungunya.

8. Monitoring

1. Enhance skills of supervisors and line managers in monitoring and revise training modules.
2. Build databases for surveillance and programme monitoring at block, district and state levels.
3. Build capacity of managers at each level to analyze and use this information.

4. Enhance use of LQAS for programme management.
5. Ensure external evaluation of IT systems. Start by evaluating NAMMIS and learning from this to make more inter-operable IT systems in tune with capacities at district and sub-district levels and geared for maximal use at these levels.
6. Ensure regular data triangulation exercises for better understand transmission dynamics.
7. Introduce mechanisms for web-based notification system for VBDs with mandatory notification of all VBDs from public and private facilities; this is for example to be started with the states with malaria API <1.

9. Evaluation and operational research

1. Adopt a culture of evaluation. Evaluation needs also to be seen as part of operational research.
2. Identify agencies that provide support for operational research or evaluation or other forms of technical assistance, for each district and each state.
3. Invest in capacity building of knowledge/technical assistance agencies to be located in universities, medical colleges, research institutions or NGOs.

10. IEC/BCC and advocacy

1. Develop an overarching IEC/BCC strategy encompassing health programs including VBDs. In this area, there is also a need to support operational research and to develop M&E systems to inform and assess IEC/BCC activities.
2. Ensure that increased demand for services as a result of IEC/BCC and advocacy actions is matched with increased availability of services.
3. Integrate BCC with social mobilization and community participation in order to ensure sustained change.
4. Build district capacities to prioritize message content and media actions and communication to local contexts while adopting healthy behavior and prevention strategies at household level.
5. Emphasize inter-personal communication and mobilization by peripheral health workers and community organizations paired with printed media to ensure a common understanding of technical content of messages with the electronic mass media so as to build an enabling environment for one to one approaches.

Final considerations

In India, the challenge is to ensure the implementation of interventions of proven efficacy and ensure they universally reach **all** populations, ensuring action across the central, state and local levels involving all concerned stakeholders⁴³. Applying a health systems approach to the analysis of a VBD control strategy allows us to define key components and governance mechanisms needed to attain a sustainable control of VBDs for the country.

A health system approach will allow the exploration of how service provision should be designed in order to achieve equity in access to VBDs interventions, based on strengthened service provision, financing, resource generation and stewardship functions. A health systems approach will also ensure financial protection, shielding populations from impoverishment due to a VBD.

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